

REMARKS

Restriction requirement

Claims 1-54 have been restricted to claims 1-52 and claims 53-54. Consistent with the Examiner's telephone conversation with James McDaniel on September 16, 2005, Applicant without prejudice hereby elects examination of claims 1-52, and thus has withdrawn claims 53-54.

Objection to specification

Paragraph [0035] of the specification has been objected to because the number 82 in lines 7 and 9 should be the number 83. Applicant has made this correction, and requests the withdrawal of this objection.

Objection to claims

Claim 31 has been objected to because "an layer" in line 2 thereof should read "a layer." Applicant has made this correction, and requests the withdrawal of this objection.

Claims 1-10

Claim 1 is an independent claim, from which claims 2-10 ultimately depend. Claims 1 and 4 have been rejected under 35 USC 102(b) as being anticipated by Tzu (6,093,507). Claims 1 and 4-6 have been rejected under 35 USC 102(b) as being anticipated by Cauchi (2003/0113674). Claim 2 has been rejected under 35 USC 103(a) as being unpatentable over Tzu '507 or Cauchi '674 in view of Noritake (2002/0076845). Claim 3 has been rejected under 35 USC 103(a) as being unpatentable over Tzu '507 or Cauchi '674 in view of Cauchi (2004/0101790). Claims 7-10 have been rejected under 35 USC 103(a) as being unpatentable over Tzu '507, Cauchi '674, Tzu (6,007,324), Okoroanyanwu (6,589,713), and/or Cauchi '790.

Applicant submits that claim 1 as amended is patentable over the prior art references cited by the Examiner, either alone or in combination. In particular, the claim limitations of claim 2 have been substantially (but in a more broadened manner) been incorporated into claim 2, and claim 2 has been cancelled. Insofar as the Examiner rejected claim 2 over Tzu '507 or Cauchi '674 in view of Noritake, Applicant discusses why claim 1 as amended is patentable as to Tzu '507 or Cauchi '674 in view of Noritake. Claims 3-10 are patentable at least because they depend from a patentable base independent claim.

Claim 1 is now limited where the method of forming a depression in a surface of a layer of photoresist includes the step, act, or part of "forming the depression at the surface of the layer in the first or second portion of the layer by baking the layer." Applicant submits that this limitation of claim 1 in particular is not rendered unpatentable over Tzu '507 or Cauchi '674 in view of Noritake. As support, Applicant provides two independent and separate reasons why claim 1 as amended is patentable. First, Tzu '507 or Cauchi '674 in view of Noritake does not teach, disclose, or suggest all the claim limitations of claim 1. Second, Tzu '507 or Cauchi '674 is not properly combined with Noritake, insofar as modifying Tzu '507 or Cauchi '674 in view of Noritake would render Tzu '507 or Cauchi '674 unsatisfactory for its intended purpose. Each of these reasons is now discussed in detail.

The prior art does not teach, disclose, or suggest all the claim limitations of claim 1

Applicant first submits that Tzu '507 or Cauchi '674 in view of Noritake does not teach, disclose, or suggest all the claim limitations of claim 1 as amended. In particular, Applicant submits that Tzu '507 or Cauchi '674 in view of Noritake does not teach, disclose, or suggest "forming the depression at the surface of the layer in the first or second portion of the layer by baking the layer," as to which the claimed invention is limited. "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." (MPEP sec. 2143.03.)

The claimed invention is thus limited to forming the depression at the surface of the layer *by baking the layer*. The Examiner has noted that Tzu '507 and Cauchi '674 fail to disclose forming a depression at the surface of the layer. (Office action, p. 6, para. 10.) Instead, the Examiner finds this aspect of the claimed invention in Noritake, specifically in paragraph [0032] thereof. (Id.)

However, Noritake, and therefore Tzu '507 or Cauchi '674 in view of Noritake, does not teach, disclose, or suggest forming the depression in question *by baking the layer*, in contradistinction to the claimed invention. Rather, Noritake discloses the following in paragraph [0032]: "Step 4 (FIG. 1(d)): after the second mask 72 is removed, *the photosensitive resin film 70 is developed whereby a concave 74* and a contact hole 73 *are formed.*" Thus, in Noritake, and therefore in Tzu '507 or Cauchi '674 in view of Noritake, the depression (i.e., the concave) is formed by the developing the layer in question – not by baking the layer, as in the claimed invention.

Therefore, Tzu '507 or Cauchi '674 in view of Noritake does not teach, disclose, or suggest all the claim limitations, such that the claimed invention of claim 1 is patentable over Tzu '507 or Cauchi '674 in view of Noritake.

Tzu '507 or Cauchi '674 is not properly combined with Noritake

Second, Applicant submits that Tzu '507 or Cauchi '674 is not properly combined with Noritake. "If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." (MPEP sec. 2143.01.V.) Applicant submits that modifying Tzu '507 or Cauchi '674 to form a depression as taught in Noritake would render Tzu '507 and Cauchi '674 unsatisfactory for their intended purposes, such that there is no suggestion or motivation to modify Tzu '507 or Cauchi '674 in view of Noritake.

With respect to Tzu '507, this prior art reference is directed to a "simplified process for fabricating . . . phase shifting masks." (Title.) Such "phase shifting masks improve feature definition and process latitude" but "are more complex to design and fabricate." (Col. 1, ll. 62-64) Therefore, the "principle objective of this invention" is "to provide a method of forming phase shifting masks which require only one resist application which can be exposed by a single electron beam using different exposure doses." (Col. 2, ll. 14-17)

Thus, Tzu '507 teaches a process by which a single resist layer is exposed to two doses of radiation, and, as the Examiner has noted, baking occurs at some point in this process. Particularly, after exposure of the layer of resist to two doses, "[a]s shown in FIG. 4, the layer of resist 24 is then developed and baked thereby forming the first pattern 23 in the entire thickness of the layer of resist and the second pattern 25 in only the top portion of the layer of resist." (Col. 3, ll. 33-38) These patterns 23 and 25 ultimately result in a phase shifting mask having "both a phase shifting mask region 13 and a binary mask region 15," which "can be seen in FIG. 9." (Col. 9, ll. 9-11) That is, FIG. 9 shows how the phase shifting mask of Tzu '507 includes the regions 13 and 15 that encompass the patterns 23 and 25.

However, if you modify Tzu '507 in view of Noritake, to yield a depression or a "concave" in the pattern 23 and/or in the pattern 25 of Tzu '507, you no longer have a phase shifting mask. That is, the phase shifting mask region 13 and the binary mask region 15 of the phase shifting mask would be changed, and no longer would the patterns 23 and/or 25 as taught in Tzu '507. The purpose of phase shifting masks is "to improve feature definition" (col. 1, l. 62), but if a depression is yielded in the patterns 23 and/or 25, you actually lose feature definition, because the patterns 23 and/or 25 of FIGs. 4 and 9 would be softened by the included depression. In other words, instead of having sharp edges as shown in FIGs. 4 and 9, forming a depression within either or both of the patterns 23 and 25 would intrinsically change the shape of these patterns, perhaps widening them, and at least softening their sharp edges.

As such, the process of Tzu '507 would no longer be able to fabricate a desired phase shifting mask as is specifically taught in Tzu '507. The proposed modification, in other words, would render the prior art invention of Tzu '507 being modified unsatisfactory for its intended purpose – namely, to fabricate a desired phase shifting mask. Therefore, Tzu '507 is not properly modified in view of Noritake, such that the claimed invention is patentable over Tzu '507 in view of Noritake.

With respect to Cauchi '674, this prior art reference yields “more faithful pattern reproduction” on semiconductor wafers. (Paras. [0006], [0002].) Cauchi '674 notes that within the prior art, the “resist pattern on wafer 110 is not always a faithful reproduction of the mask.” (Para. [0003]) In particular, Cauchi '674 cites the example that “the mask 140 has a concave corner 220M,” such that “[f]eature 220M should ideally be printed (reproduced) in resist 120 as feature 210R, with a corner 220R.” (Id.) However, Cauchi '674 notes that “the resist region 230 in the corner’s cavity gets underexposed” such that “[a]s a result, the corner is smoothened in the resist pattern.” (Id.) Therefore, Cauchi '674 teaches a process to “reduce underexposure of the resist,” where “the resist is exposed twice,” (para. [0006]), as the Examiner has noted. (Office action, p. 4, para. 8.) By reducing underexposure of the resist – via exposing the resist twice – a more faithful reproduction of the features of the mask onto the resist can result. (Para. [0006])

However, if you modify Cauchi '674 in view of Noritake, to yield a depression of a “concave” in the resist, you no longer have a more faithful reproduction of the features of the mask onto the resist. Rather, portions of the resist will become depressions, or “concaves,” and thus no longer correspond to the mask. Indeed, insofar as such depressions or “concaves” soften the features of the mask onto the resist, you end up with the exact same problem that Cauchi '674 is trying to solve – where a corner feature, for instance, is undesirable “smoothened in the resist pattern.” (Para. [0003])

The intended purpose of the teachings of Cauchi '674, in other words, is to better and more faithfully reproduce the features of a photomask on the photoresist layer on a

semiconductor wafer. However, modifying Cauchi '674 in view of Noritake renders Cauchi '674 unsatisfactory for this intended purpose. Instead of more faithful reproduction of the mask features on the resist, you end up with less faithful reproduction, due to the inclusion of a depression or "concave" in some portions of the resist, where this depression or "concave" is not present in the mask itself. Thus, the proposed modification would render the prior art invention of Cauchi '674 being modified unsatisfactory for its intended purpose. Therefore, Cauchi '674 is not properly modified in view of Noritake, such that the claimed invention is patentable over Cauchi '674 in view of Noritake.

Claims 11-30

Claim 11 is an independent claim, from which claims 12-30 ultimately depend. Claims 11-12, 16, 21-26, and 29-30 have been rejected under 35 USC 103(a) as being unpatentable over Tzu '324 in view of Cauchi '674. Claims 13-15 have been rejected under 35 USC 103(a) as being unpatentable over Tzu '324 in view of Cauchi '674, and further in view of Okoroanyanwu. Claims 27 and 28 have been rejected under 35 USC 103(a) as being unpatentable over Tzu '324 in view of Cauchi '674, and further in view of Cauchi '790. Claims 17-20 have been rejected under 35 USC 103(a) as being unpatentable over Tzu '507, Cauchi '674, Tzu '324, Okoroanyanwu '713, and/or Cauchi '790.

Claim 11 has been amended similar to the manner in which claim 1 has been amended. Therefore, Applicant submits that claim 11 is patentable over the cited prior art, either alone or in combination, for at least the same reasons that claim 1 is patentable, as has been discussed above. Claims 12-30 are patentable at least because they depend from a patentable base independent claim.

Claims 31-52

Claim 31 is an independent claim, from which claims 32-52 ultimately depend. Claims 31-36, 41-48, and 52 have been rejected under 35 USC 103(a) as being unpatentable over Tzu '324 in view of Cauchi '674, Okoroanyanwu, and/or Cauchi '790, and further in view of Makigaki (6,863,375). Claims 37-40 and 49-51 have been rejected under 35 USC 103(a) as being unpatentable over Tzu'507, Cauchi '674, Tzu '324, Okoroanyanwu '713, and/or Cauchi '790.

Claim 31 has been amended similar to the manner in which claim 1 has been amended. Therefore, Applicant submits that claim 31 is patentable over the cited prior art, either alone or in combination, for at least the same reasons that claim 1 is patentable, as has been discussed above. Claims 32-52 are patentable at least because they depend from a patentable base independent claim.

Conclusion

Applicants have made a diligent effort to place the pending claims in condition for allowance, and request that they so be allowed. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Mike Dryja, Applicant's representative, at 425-427-5094, so that such issues may be resolved as expeditiously as possible. For these reasons, and in view of the above amendments, this application is now considered to be in condition for allowance and such action is earnestly solicited.

Respectfully Submitted,



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Date

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